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NEW HAMPSHIRE
AGRICULTURAL
EXPERIMENT STATION,

HANOVER, N. H.,

BULLETIN NO. 7.

TEST OF DAIRY APPARATUS.

MAY, 1889.

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— OF THE —

NEW HAMPSHIRE

Agricultural Experiment Station.

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TEST OF DAIRY APPARATUS.

The following are the results of a test made at the New Hampshire Experiment Station, January 8, 9 and 10, 1889.

The accompanying "rules" were read before, and sanctioned by, the President and Secretary of the Granite State Dairyman's Association, the Secretary of the State Board of Agriculture and the Director of the Experiment Station; the same persons agreed upon the following committee to conduct the work: J. L. Gerrish, Secretary Dairyman's Association, Geo. S. Philbrick member of the State Board of Agriculture, and D. S. Bridgman of Hanover. The Experiment Station was to furnish apparatus, provide milk, and so far as possible render assistance in way of manual labor etc. The chemical work was to be done at the Station Laboratory.

RULES FOR TESTS OF DAIRY APPARATUS.

"At the Farmer's Institute, to be held by the New Hampshire Board of Agriculture, Granite State Dairyman's Association, and New Hampshire Agricultural Experiment Station, at Hanover, N. H., Jan. 8, 9, and 10, 1889, the following tests will be made:

First. Comparative test of Moseley and Stoddard, Cooley, Johnson Top Can Separator, and the DeLaval Hand Power Separator; also any other apparatus manufacturers of which, may express a desire to enter in this test before Jan. 1st.

Second. A test of churns, including Stoddard, Davis, and Blanchard, and any other which manufacturers may request to have tested; this request to be made before Jan. 1st.

RULES.

1. One representative of each system will be allowed to witness all operations, to see that each variety of apparatus is handled as it should be, the actual work, however, will be performed by men selected by the Director of the Station, the Sec-

retary of the Board of Agriculture and the Secretary of the Dairyman's Association.

2. Seventy five pounds of milk will be used by each system Tuesday morning, Jan. 8, and seventy-five pounds by each system, Tuesday night; each test will, therefore, consist of one hundred and fifty pounds of milk.

3. The cans used by each competing manufacturer shall be their usual cans, used in the common way; the hand power separator shall be the DeLaval vertical, run at not less than forty, nor more than forty six turns a minute.

4. The temperature of the milk, which shall all be of the milking corresponding with the time of setting or separating, may be anywhere from 70° to 90° , as each system may desire.

5. All milk will set twenty four hours in water at any temperature desired, from 40 up, and the skimming will be by the surface skimmer of the Moseley and Stoddard and the bottom skimming device of the Cooley, and all others, in like manner, by their common advertised method. The milk will be run through the hand separator as soon as the whole milk is divided into three parts, a sufficient quantity of the skim milk being poured back and run again, to displace the cream in the bowl.

6. The "separated" cream will be held in ice water until Wednesday night, as will the first skimming from the deep setting; Wednesday night, when the last skimming is done, all the cream from each system will be warmed to 85° and will stand in the same rooms at a temperature as near 65° as is possible; it will be regularly and equally stirred at such times as may be agreed upon until it is time to put it in the churn.

7. Churning will commence as near 8 A.M., Thursday the 10th, as possible, and, as each lot will be churned in the same churn, lots will be drawn to determine the order of churning.

The temperature of the cream will be such as each representative of the respective systems shall decide upon within 58° to 68° and the churning shall proceed at such rate of speed as is desired by each; the butter-milk shall be removed by washing, as far as is possible, and the butter, after being washed in the churn, shall hang in a cheese cloth bag twenty minutes, it shall then be weighed, and for each pound one ounce of salt shall be added; it shall then be worked by some experienced butter maker on a Skinner worker; said butter maker

shall not know the identity of the samples and shall work them as uniformly as he can.

The salted butter shall then be weighed and samples be taken for analysis.

Samples of milk, skim milk, and butter-milk shall also be taken, and shall be analysed.

8. The final award of merit shall rest upon the basis of the per cent of *actual fat*, (as determined by analysis of the milk, and the weight of the milk) *that is recovered* in the butter; (also determined by analysis of the butter.) To make this clear, I will give an example. Suppose the milk to contain 4% of fat 150 lbs. $\times .04 = 6.00$ lbs. actual fat. Suppose this to make $6\frac{1}{4}$ lbs. of butter containing 80% of fat, $6.25 \times .80 = 5$ lbs. of fat in butter; that is, out of six pounds of fat in the milk five have been recovered in the butter or $83\frac{1}{3}\%$ of the total fat of the milk is found in the butter; this represents the efficiency of the system used.

The quality of the butter from each system will also be determined by an expert."

The committee conducted the tests without mishap in any part of the work.

The Johnson Top Can Separator, a new device for raising cream by cold deep setting, was not in working shape as only half the necessary number of cans were brought, and consequently one setting stood but nine hours and the other but thirteen and a half, this renders it impossible to compare the results of this system with the others. I have given the figures however.

The work of mixing, and dividing the milk was done with the greatest of care. The order of taking out the night's setting being the reverse of the morning's, so that all danger of getting richer milk at the top might be avoided, since the system that took the *top* milk in the morning took the bottom milk at night.

The Centrifugal Separator used was run by hand power, and of course did not skim as thoroughly as the larger machines that run by steam power.

Table I gives the following details of the work.

The amount of milk, the temperature at which it was when set, the temperature of the water in which it was set, the time

that elapsed before skimming, the spaces of cream, and the weight of the same, the time required for churning, temperature of cream when churned, the amount of skim-milk and the fat in it as shown by analysis.

TABLE I.

		MILK.					CREAM.			SKIM-MILK.		BUTTER-MILK.		BUTTER.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
		Amount set.	Temperature of milk.	deg.	deg.	deg.	Time milk set.	Spaces.	Amount.	Time required to churn.	Temperature when churned.	Amount.	Per cent. of fat in	lbs.	Amount.	Per cent. of fat in	lbs. oz.	Amount.	Per cent. of fat in	Per cent. of casein in	Per cent. of water in	Quality, 100 being perfect.	Efficiency of system.	Milk required per pound of butter.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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*Time of separating, in minutes.

The amount of butter-milk, (this was determined by subtracting from the weight of cream the weight of the drained butter, this is the most accurate method, for it is impossible to draw off all the butter-milk and weigh it, as a portion will be left in the butter and must be worked or washed out,) the % of fat in the butter-milk, the % of water, fat, and casein in the butter, the amount of butter, its quality as determined by experts who knew nothing of the identity of the samples, the efficiency of the systems and the pounds of milk required per pound of butter.

The committee of experts who examined the butter consisted of C. H. Waterhouse President of the New England Creamers Association, and H. W. Sadd of Connecticut.

The butter was marked in the following scale for perfect butter: Flavor, 50, Grain, 25, Color, 15, Salt 10.

Table II gives the full marking of each sample.

	Perfect butter would mark :	Moseley and Stoddard.	Cooley.	Johnson top can.	Shallow six quart pan.	DeLaval hand separator.
Flavor,	50	40	43	50	45	41
Grain,	25	25	20	18	25	25
Color,	15	14	12	8	15	10
Salt,	10	10	10	10	10	10
Total,	<hr/> 100	<hr/> 89	<hr/> 85	<hr/> 86	<hr/> 95	<hr/> 86

The efficiency of the various systems is based upon the per cent of the total fat in the milk which is found in the butter, (See rule 8 of "Rules of Test") this was taken because it is the only true test. If one system gives a cream which churns less thoroughly than the cream given by another system, it is just as much to the discredit of the former as though the fat was left in the skim-milk, consequently if we are to arrive at a knowledge of the value of any given system we must follow the original fat in the milk through to the lump of butter, and find the per cent of this fat that is recovered.

Of the fat not recovered in the butter, the greater the part of it that is left in the skim-milk, and the less the part left in the butter-milk the better, because of the fact that skim-milk is in better shape to feed to calves than butter-milk. First get as

large a per cent of the total fat as possible into the butter, second, of the portion not recovered get as little as possible in the butter-milk.

The milk used in these tests was sampled and analyzed. Morning's milk had 3.93% of fat, night's milk 3.99% of fat.

The following table shows the amount of fat in the milk, the amount lost in the skim-milk and butter-milk and the amount recovered in the butter :

	Moseley and Stoddard. lbs.	Cooley. lbs.	Open pans. lbs.	Separator. lbs.
Total fat in milk,	5.9400	5.9400	5.6500	5.9400
Lost in skim-milk,	.3246	.3094	.3976	.4315
Lost in butter-milk,	.6020	.8718	.2140	.1089
Recovered in butter,	4.8776	4.7734	5.1450	5.4118
	per cent.	per cent.	per cent.	
Per cent of Total fat lost in skim-milk,	5.47	5.21	7.03	7.26
Per cent of Total fat lost in butter-milk,	10.13	14.67	3.78	1.83
Per cent of Total fat recovered in Butter,	82.11	80.36	91.07	91.10

If perfect work could be done and if there was such a thing as absolute accuracy, the sum of the fat in butter, skim milk and butter-milk would equal the total fat in the milk used, but there are small errors in weighing, and in chemical analysis and sampling which are unavoidable. Every chemist recognizes certain limits of error in his work; every investigator realizes that weighings made with standard scales are imperfect; as a result we find just what would be expected, namely, that the sum of the fat in butter, skim-milk and butter-milk in each system does not correspond exactly with the fat in the milk, but if we take the four lots it appears that we had, in the milk used 23.47 pounds of fat and there is accounted for 23.46 pounds, an error of less than one-sixth of an ounce, hence we may reasonably conclude that these errors, as a whole, balance.

The figures are so plain that comment is unnecessary, and so far as one test conducted by competent and careful men can be relied upon we may place the Separator first, the Open pans second, the Moseley and Stoddard third, and the Cooley last, in point of efficiency.

HOW THE CREAM WAS RIPENED.

The separated cream was at once placed in water and surrounded with ice the temperature being kept at about 34° , the first skimmings of the milk that was set was also kept in ice water, and at this temperature no appreciable amount of "ripening" could have taken place. The shallow pans were not skimmed until 4 p. m., Wednesday, the temperature of the room varying from 47° to 55° .

At 6:36 p. m. Wednesday all the cream was removed from ice water and warmed up to 85° and set in a room, the temperature of which was 63° , here it remained until 10:30 a. m., Thursday, it had, therefore, sixteen hours in which to ripen. It is a well known fact that cream at 85° ripens much faster than cream at 60° , hence the time allowed for ripening was not uncommonly short, but, on the contrary, was well up to that allowed in most creameries, and, while there is no absolute standard by which degrees of "ripeness" may be determined, I have no doubt that the cream used in these tests was as well ripened in 16 hours after being warmed to 85° as it would have been in 24 hours at 62° . This was carefully considered when "Rule 6" was framed, for it was known that 24 hours could not be allowed, consequently the higher temperature was introduced to compensate for the lack of time. The circumstances were such that two and one half hours additional time was given more than Rule 7 calls for, it is only fair to suppose, therefore, that the cream was of average ripeness.

Lots were drawn to determine the order of churning, the Shallow pans were first, Stoddard second, Separator third, Cooley fourth, Johnson fifth. Two Stoddard churns were secured so that with the Shallow pans and the Stoddard cream, churning commenced at 10:48 a. m., Thursday, with the Separator and Cooley at 12:3 p. m., and with the Johnson at 1:16 p. m.

TEST OF CHURNS.

There being a lack of time in which to make the churning tests, it was decided to have these carried on by the Station employees and the representatives of the Moseley and Stoddard, and Blanchard churns consented to leave their goods for the work.

Mr. A. H. Wood Supt. Dairy work, has carried out the following experiments, the chemical work being done by Mr. E. H. Farrington.

The cream for each test was kept in one vat and ripened and then divided into three lots.

The cream for the first trial was held thirty hours and was *sweet*. The second trial was the same, but the third was warmed up to 70° and allowed to stand until it gradually fell to 55°, it was again warmed and in all stood thirty hours, it was slightly acid.

TABLE II.

	DAVIS.			BLANCHARD.			STODDARD.		
	First trial.	Sec'd trial.	Third trial.	First trial.	Sec'd trial.	Third trial.	First trial.	Sec'd trial.	Third trial.
Amount of cream, lbs.,	42	47.4	39	42	47.4	39	42	47.4	39
Time of churning, min.,	19½	28½	24½	44	53½	41½	24	32½	30½
Temperature of cream, deg.,	62	61	62½	62	61	62½	62	61	62½
Amount salted butter, lbs.,	13.0	14.81	12.00	13.34	15.69	12.09	12.75	15.09	12.69
Amount buttermilk, lbs.,	27	31	26½	27	31	26½	27	31	26½
Per cent of fat in buttermilk,	2.14	1.19	2.02	2.61	1.26	1.94	2.30	1.24	1.82
Per cent of fat in butter,	—	85.16	82.84	—	79.07	82.70	—	83.46	79.43
Total fat in butter, lbs.,	—	12.61	9.94	—	12.41	10.00	—	12.6	10.08
Total fat in buttermilk, lbs.,	—	.38	.53	—	.40	.51	—	.40	.48
Speed of churn, per min.,	45	45	45	60	65	65	60	65	65

The table given above shows the details of each trial for each churn.

The butter from the first trial was not analyzed, but the butter-milk was and as the thoroughness of churning is shown by the per cent of fat left in the butter-milk, the work is not injured by the absence of the butter analysis in this case.

The following table gives the per cent of fat in the butter-milk from each churn for each trial, and also the average of the three trials.

BUTTER MILK.

	Analysis of.			
	1st trial.	2nd trial.	3d trial.	Average.
Davis,	2.14	1.19	2.02	1.78
Blanchard,	2.61	1.26	1.94	1.93
Stoddard.	2.30	1.24	1.82	1.78

In the three trials 128.4 pounds of cream was used by each system, with the following results:

Davis swing, made	39.81 pounds of salted butter.
Blanchard, made,	41.12 pounds of salted butter.
Stoddard, made,	40.53 pounds of salted butter.

Taking the last two trials where analyses of both butter and butter-milk was made, and we found that from 86.9 pounds of cream the

Davis made,	26.81 pounds of salted butter.
Blanchard made,	27.78 pounds of salted butter.
Stoddard made,	27.78 pounds of salted butter.

From the analyses of the butter, we find that each of the foregoing amounts of butter, had of *actual butter fat* the following :

Davis,	22.55 lbs. of fat ; lost in butter-milk, 0.91 lbs.
Blanchard,	22.41 lbs. of fat ; lost in butter-milk, 0.91 lbs.
Stoddard,	22.68 lbs. of fat ; lost in butter-milk, 0.88 lbs.

The total fat in both butter and butter-milk being :

Davis,	23.46 lbs. ;	96.1 per cent. of this was in the butter.
Blanchard,	23.32 lbs. ;	96.1 per cent. of this was in the butter.
Stoddard,	23.56 lbs. ;	96.2 per cent. of this was in the butter.

These results show that there is practically no difference in the efficiency of these three churns and if there is any preference it must come from convenience in handling, and ease of operation ; on this point there is no doubt in the mind of those who have actually operated the churns here at the Station, for ease of handling and cleaning, and for perfection of granulation of butter the Stoddard churn stands at the head. The Blanchard is open to the objection that it has inside floats, which interfere seriously with the granulating of the butter. The Davis is harder to operate than either of the others, and is more difficult to clean when the churning is done. The average time of churning was twenty four minutes for the Davis, forty-seven minutes for the Blanchard and twenty-nine minutes for the Stoddard. The Davis leads in point of time required.

BUTTER EXHIBIT.

The following letter was sent to each creamery in the State, so far as the address was known:

"A three days Farmer's Institute is to be held here Jan. 8-9-10- The third day will be under the control of the Granite State Dairymans Association and we are very anxious to have a good exhibit of butter and cheese and want you to favor us with a five pound box of your butter.

This butter will all be tested by an expert butter tester and will be sampled, and the samples analyzed free of expense at the Experiment Station Laboratory. This will give very valuable information to all butter makers, and it is especially desirable that we get samples of all the creamery butter in the State.

Yours truly

G. W. WHITCHER."

Private dairymen were also invited to send samples.

As a result fourteen Creameries sent twenty-two samples, and eleven private dairies sent twenty-four samples. The following is the full list of butter that was examined by Mr. H. K. Slayton of Manchester. The first, second and third awards in each class being indicated.

"S" indicates Separator, "C," Cooley.

Name of creamery.	Location.	Station No. of sample.	
West Lebanon, S,	West Lebanon,	A-109	1st
West Lebanon, S,	West Lebanon,	A-110	
West Lebanon, S,	West Lebanon,	A-111	
C. G. Britton, C,	Keene,	A-102	2nd
Hanover, S,	Hanover,	A-101	3rd
L. T. Hazen, S,	Whitefield,	A-105	
Lyme, S,	Lyme,	A-100	
Oyster River, C,	Durham,	A-104	
Cornish, S,	Cornish,	A-106	
Alstead, C,	Alstead,	A-107	
Cold Brook, C,	Franklin,	A-103	
Cold Brook, C	Franklin,	A-118	
Piermont, S,	Piermont,	A-108	
Short Falls, S,	Epsom,	A-112	
Center Strafford, S,	Strafford,	A-113	
Center Strafford, S,	Strafford,	A-114	
Center Strafford, S,	Strafford,	A-115	
Center Strafford, S,	Strafford,	A-116	
Center Strafford, S,	Strafford,	A-117	
E. M. Smith, C,	Peterborough,	A-119	
E. M. Smith, C,	Peterborough,	A-120	
Grantham, C,	Grantham,	A-121	

PRIVATE DAIRY.

Name.	Location.	System usrd.	Station No
J. F. Johnson,	Norwich, Vt.,	Cooley,	B-100

Name.	Location.	System used.	Station No.
J. F. Johnson,	Norwich, Vt.,	Cooley,	B-101
E. A. Perley,	Lebanon,	Cooley.	B-102
L. T. Hazen,	Whitefield,	Separator,	B-103 2nd
J. L. Gerrish,	Webster,	Milk set in tin sap pails,	B-104
W. D. Baker,	Quincy,	Lincoln Channel Cans,	B-115
W. D. Baker,	Quincy,	Lincoln Channel Cans,	B-116 1st
W. D. Baker,	Quincy,	Lincoln Channel Cans,	B-117
W. D. Baker,	Quincy,	Lincoln Channel Cans,	B-117
W. D. Baker,	Quincy,	Lincoln Channel Cans,	B-118
Exp. Station,	Hanover,	Separator,	B-105 3d
Exp. Station,	Hanover,	Separator,	B-106
Exp. Station,	Hanover,	Separator,	B-107
Exp. Station,	Hanover,	Separator.	B-108
Exp. Station,	Hanover,	Separator,	B-109
Exp. Station,	Hanover,	Separator,	B-110
Exp. Station,	Hanover,	Separator,	B-111
Exp. Station,	Hanover,	Separator,	B-112
Mr. Fairbanks,	Hanover,	Ferguson,	B-113
Mr. Fairbanks,	Hanover,	Ferguson,	B-114
C. W. Emery,	Canterbury,	Woosters creamer,	B-119
C. W. Emery,	Canterbury,	Woosters creamer,	B-120
F. Little,	Peterborough,	(?)	B-121
A. O. Smith,	Peterborough,	(?)	B-122

The following is the description of the method used in making the butters that were awarded first, second and third places in each class.

CREAMERY.

First Award. West Lebanon Creamery Co-operative, milk gathering, mixed milk from Jersey and native cows, run through DeLaval Separator, cream ripened twenty hours as near 62° as possible, churned in Blanchard Box churn at 64°, butter washed in granular form with water at 55°, Higgins salt, Wells, Richardson & Co., butter color, Blanchard butter worker used.

This sample was taken from a lot of 450 pounds churned at one time.

Signed

J. H. BICKFORD, Butter-maker.

Second Award. C. G. Britton's proprietary Creamery, milk from mixed breeds set in Cooley Creamer, cream ripened eighteen hours at 66° and churned at 65° in Davis churn, washed when in granular form in water at about 50°, Lever worker used, Genesee salt and Fletcher's butter color used.

Signed

C. G. Butler, Keene, N. H.

Third Award. Hanover Creamery Co-operative, milk gathering, milk from mixed breeds, run through DeLaval Separator, cream ripened about twenty four hours at about 60°, churned in Blanchard churn, washed when in granular form in water at 60°, worked with Blanchard worker, salted with Higgins salt and colored with Hansens butter color.

Signed

Henry Cummings, butter-maker.

PRIVATE DAIRY.

First Award. W. D. Baker. Milk from Holstein-Jersey cross, set in Lincoln Channel Can creamer, cream ripened twelve hours at 75°, one quart of butter-milk was added to the cream to assist in ripening, churning was done in Davis churn, cream at a temperature of 66°, worked in granular form in water at 50°. No color used.

Signed

W. D. Baker.

Second Award. L. T. Hazen. Milk from Jersey cows, run through DeLaval Separator, cream ripened thirty-six hours, and churned at 62° in Box churn, washed in granular form with water at 50°, Ashtons salt and Hansens butter color used.

Signed

L. T. Hazen.

Third Award New Hampshire Experiment Station. Milk from Jersey cows, run through DeLaval Hand power Separator, cream ripened twenty-four hours at 65°, churned in Stoddard churn at 62°, washed in granular form in water at 52°, worked on Skinner worker, Higgins salt and Hansens butter color used.

Signed

A. H. Wood, Supt. Dairy Dept

Samples were taken from each lot of creamery butter and from part of the private dairy butter, these were analized at the

Station Laboratory, the per cent. of water, fat, and casein, being determined, the salt etc. is found by difference.

The volatile fatty acids are also given, these are determined by a process in which a definite amount of the pure butter fat is converted into soap by a solution of potash, to which alcohol is added, after this the alcohol is driven off by heat, then water and a solution of phosphoric acid are added and the mixture distilled until a given amount is collected. This distillate contains the volatile acids, this is neutralized with a solution of soda of known strength, and the figures given show the number of parts of this soda solution required to neutralize the acids. This test is much used in detecting adulteration or in distinguishing oleomargarine from pure butter.

Table III gives the full analysis of each sample. By some error the casein was not determined in the sample made at the Experiment Station.

TABLE III.

Name of exhibitor.	No. of sample.	Per ct. water.	Per ct. fat.	Volatile acids = c. c. soda so- lution.	Casein.	Salt, etc., by difference.
Lyme creamery,	A100	13.08	81.98	15.3	.756	4.18
Hanover creamery, 3d prize,	A101	11.24	85.07	15.3	.544	3.15
Keene creamery, 2nd prize,	A102	11.33	84.39	15.2	.700	3.58
Cold Brook creamery, Franklin,	A103	7.60	88.49	14.8	.576	3.33
Oyster River creamery, Durham,	A104	9.19	85.74	15.5	.781	4.29
Island View creamery, Whitefield,	A105	14.37	80.32	14.5	.560	4.75
Cornish creamery,	A106	15.70	79.87	15.5	.960	3.47
Cold River creamery, Alstead,	A107	8.51	87.86	14.6	.743	2.89
Piermont creamery,	A108	13.22	81.21	15.8	.697	4.98
West Lebanon creamery, 1st prize.	A109	12.69	82.15	15.4	.650	4.51
Short Falls creamery,	A112	14.94	82.45	14.6	.706	1.91
Center Strafford creamery,	A113	10.00	87.30	14.7	.377	2.32
Cold Brook creamery, print,	A118	11.90	82.35	15.8	.669	5.18
Peterboro creamery,	A119	12.26	83.77	15.3	.631	3.34
Grantham creamery,	A121	9.41	86.26	14.7	.650	3.68
E. A. Perley, dairy, Lebanon,	B102	12.15	85.40	15.0	.545	1.91
L. T. Hazen, dairy, Whitefield, 2nd,	B103	11.86	82.85	16.1	.925	4.37
J. L. Gerrish, dairy, Mast Yard,	B104	8.08	85.19	15.1	.756	5.98
W. D. Baker, Quincy, 1st,	B116	8.43	81.10	15.8	.669	2.80
N. H. Exp't Station, Hanover, 3d,	B105	10.12	85.32	15.5	(?)	(?)
Averages,		11.30	84.30	15.2	.678	3.66

The averages in the above table must closely correspond with the average of the best butter made in the State. For the sake of comparison I have collected data which gives the following general average composition of many samples of butter: Water 12.48; Fat 84.77; Casein .73; Salt etc. 2.02; volatile acids—to 14 c.c. standard soda solution.

The butter exhibited show a large per cent. of salt, but this is demanded by the customers as a general thing. The casein is low but there is possibility of improvement here, we should try to produce butter in our creameries with not over .5 of one per cent. of casein, the per cent. of water too should be reduced, and the fat correspondingly increased.

If I were to give a standard for creameries or private dairymen to work toward. It would be as follows : Water 10 per cent ; Fat 86 per cent ; Casein 0.5 ; Salt 3.5 ; fancy butter as a rule runs high in the per cent. of fat, high in volatile acids, low in water and casein.

In conclusion I would especially call the attention of the dairy farmer to the importance of these and similar tests as a means of improving the methods of manufacture, and the quality of the product. Dairying is fast becoming the mainstay of New Hampshire agriculture, and there is need of following every improvement, and to my mind there is no way in which the Experiment Station can render greater aid than by conducting careful tests, and reporting results.

G. H. WHITCHER, *Director.*

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